Viewpoint Paper ■

Health IT-enabled Care for Underserved Rural Populations: The Role of Nursing

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A b s t r a c t   This white paper explains the strong roles that nursing can play in using information technology (IT) to improve healthcare delivery in rural areas. The authors describe current challenges to providing care in rural areas, and how technology innovations can help rural communities to improve their health and health care. To maximize benefits, rural stakeholders (as individuals and groups) must collaborate to effect change. Because nonphysician providers deliver much of the health care in rural communities, this paper focuses on the critical roles of nurses on IT-enabled caremanagement teams. The authors propose changes in nursing practice, policy, and education to better prepare, encourage, and enable nurses to assume leadership roles in IT-enabled health care management in rural communities.

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Introduction

This paper promotes better understanding of the value that nurses participating in interdisciplinary and team-based IT-enabled healthcare projects can bring to underserved rural communities. The paper solicits development of a shared understanding among providers, professional organizations, the health information technology (HIT) industry, academic institutions, policy bodies, informaticians, and funding agencies. To realize HIT's benefits, these groups must work together. We describe the challenges of providing care in rural contexts, then discuss transformational trends affecting care in underserved rural areas. We describe how technology innovations can help to improve health in these locales. Finally, we advocate for changes in nursing practice, policy, funding, and education to better prepare nurses to assume leadership roles in the design, implementation, and evaluation of HIT-enabled care in underserved rural areas.

Challenges in Providing Care to Underserved Rural Communities

Health care in the United States is highly fragmented, too often unsafe, and infrequently evidence-based.[1,2] In rural communities, the severe shortage of healthcare providers exacerbates these problems.[3] About 20% of the United States population lives in rural areas, but only 9% of physicians practice there.[4] Nevertheless, the most acute rural healthcare workforce shortage involves nonphysician providers, including nurses, dentists, and technicians.[3]

Clinicians in underserved rural areas often have higher workloads, cover large geographic areas, have lower access to specialists, encounter problems in recruiting and retaining clinical staff, and treat a broad array of complex patients. Rural provider shortages should come as no surprise, given lower pay, lack of educational and training opportunities, high turnover rates, and isolation with often large distances to acute care facilities and specialists.[5] Although the cost of living in rural areas may be lower, patients in these areas are typically older and have less access to transportation. They also have lower levels of education, poorer housing, higher poverty rates, poorer health, and more disabilities than their urban counterparts.[5–9] For ethnic minorities, language, culture and economic factors pose additional barriers to obtaining health care.[10]

The current rural workforce crisis, coupled with the persistent decline in the production of family medicine physicians,[3] creates a mandate for healthcare planners to design

and implement new, collaborative models for interdisciplinary care delivery. The ability of such models to improve care and reduce local professionals' attrition will depend on the effective use of HIT and information and communication technologies (ICT). However, to realize the benefits of HIT, competent informatics practitioners must drive development and use. Given the requirement for more technologically competent midlevel providers, educators need to create new professional roles, opportunities, and expectations within the nursing profession. In part because nurses, nurse practitioners and other midlevel providers already comprise a significant proportion of the rural health care labor force, maximizing their roles in new HIT-enabled delivery models is both prudent and overdue.[11]

The nursing shortage, the low informatics competency of the healthcare workforce, and the low penetration of HIT in underserved communities comprise barriers to achieving these goals. To overcome the barriers requires leaders who can envision how technology can best support care management. Those leaders also must guide the interdisciplinary effort needed to deliver IT solutions for the underserved. Improving health and health care in underserved rural communities is a complex issue that will require system-wide solutions and attention to social determinants of health. Focusing on solitary issues in rural health care (e.g., use of HIT) without addressing the systems and context in which the issues occur will impede rather than enhance the ability to improve health. Put simply, the challenges to providing effective health care in underserved rural communities are multifaceted, but not insurmountable. Changing the landscape, however, will require new ways of thinking, innovative technologies, removal of inter-professional barriers, and candid assessments. We explore these in the following section.

Changing the Landscape

The convergence of several healthcare trends[12] makes it possible to imagine a future where providers and patients work together as partners, geography becomes irrelevant, and technology is used as the basis for shared communication, knowledge exchange, and education. For example:

- The Internet has "flattened" the healthcare landscape.[12] A survey of 800 rural United States hospitals found that nearly all had access to broadband networks and 80% had access to T1 or T3 lines.[13]
- Information and communication technologies allow accessibility to information so that underserved rural populations can see for themselves the disparate levels of healthcare in rural versus urban areas.
- Underserved rural patients' expectations are changing; they, too, want the latest technology.[14]
- The exception to the Stark Law and the anti-kickback statutes for Electronic Health Record Systems (EHRs) enacted in 2007 have the potential to accelerate adoption of EHRs in medical offices and clinics.[14]
- The Center for Medicaid/Medicare Services (CMS), EHR Demonstration Projects, and the Medical Home Demonstrations are refocusing attention on the use of HIT, particularly in primary and community-based care.

- A new administration in Washington, D.C. encouraged prompt passage of an economic stimulus bill that supports marked expansion in the United States HIT Sector.

As health consumerism grows and patients expect to participate in and influence decisions about their own care, the demand for HIT-enabled care will expand. The shifting focus of the Federal Government and the health care industry to encourage IT-enabled care opens new doors for nursing innovation, particularly in underserved populations. Nurses, because of their pivotal roles as care providers for many of the underserved, can be important partners in HIT development, implementation, and evaluation. In this changing landscape, nurses must expand their roles as health partners, educators, and care managers to facilitate wise and effective use of health information by HIT-enabled consumers. Nurses should participate actively in the expansion of HIT-enabled care. At the same time, all health professionals must guard against increasing technological disparities (the so-called "digital divide") in underserved areas[14–16] and advocate for patient-centered and team-based health care policy.

Developing Capacity

Newer health information technologies can help to level the playing field between rural and urban settings. In doing so, they can open new venues for nursing innovation and entrepreneurship. Examples of technologies presenting opportunities that require an informed nursing presence are described in the following sections.

Electronic Health Records and Connectivity

The use of EHRs in previously medically underserved areas gains momentum as digital communication becomes available in even the most remote of areas. Increased calls for accountability of resource use and outcomes further accelerate the process. Various large health care systems now implement EHRs that link urban facilities to smaller rural hospitals to enhance continuity of care and improve access to resources. Implementation of health information exchanges (HIEs) also creates new linkages between urban health centers and rural communities.

In 2006, the Federal Communication Commission (FCC) announced a pilot program that would fund up to 85% of selected applicants' costs for building state and regional broadband networks and connecting those networks to Internet2, dedicated nationwide backbone providers, and to the public Internet.[17] As a result, the state of Nebraska constructed a communication infrastructure linking all of its hospitals. Nebraska is now interlinking the EHRs of hospitals, clinics, laboratories, and clinician offices across the state. Other HIEs are being developed, such as the Indiana Health Information Exchange (IHIE), which connects 30% of the state's population, and is improving quality and lowering costs.[18]

Rural interoperability, EHRs, and connectivity between care settings create opportunities for nurses. Nurses, who cost-effectively coordinate patients' care needs, supply community-based care, provide patient education, and help patients and families navigate the healthcare system, now stand at the intersection of innovation and opportunity.[19,20]

Telehealth and Tele-home Care Technologies

In 2007, the Federal Communications Commission dedicated over $417 million to build broadband networks in 42 states and 3 United States territories as part of the rural health care pilot program (RHCPP).[21] This project aims to link more than 6,000 public and non-profit care providers to broadband telehealth networks, enabling remote clinics and providers to access the expertise and services available in urban medical centers. A unique example is the linking (in real-time) of five rural Arizona hospitals to teletrauma specialists at the University Medical Center in Tucson, AZ. This is enabled by the partnership of Arizona Blue Cross and Blue Shield with the University of Arizona's Telemedicine for Teletrauma and Intensive Care Program.[22] Other high profile telehealth applications attempting to significantly improve access, ameliorate quality of life, and reduce costs, include the Alaska Federal Health Care Access Network (AFHCAN)[23] and Informatics for Diabetes Education and Telemedicine project (IDEATel).[24]

Home care agencies are rapidly adopting tele-home care technologies to monitor and manage patients in their homes. These efforts present tremendous opportunities for rural locales, particularly for the management of chronic diseases.[25,26] Tele-home technologies typically improve self-management, reduce re-hospitalizations, and decrease length of stay and related health care costs by lowering patients' use of acute care services, and by reducing travel expenses for patients and providers.[27] Some projects (e.g., Heart Care II and E-Care) have improved nurse-patient relationships and increased adherence to cardiac rehabilitation regimes.[28,29] The Intel Corporation released a 501(k) FDA-approved device called the Intel Health Guide, specifically designed to enable chronic disease patients' self monitoring and communication with caregivers.[30] Other nascent technologies will facilitate healthy aging at home. For example, the Center for Aging Services Technologies (CAST) is implementing IT-enabled wellness technologies that include "smart" houses and wearable computers aimed at improving seniors' quality of life and reducing health care costs by keeping them independent at home as long as possible.[31]

Telehealth and tele-home care can provide considerable value to underserved rural communities. Both technologies are projected to experience intense growth. The examples cited above, coupled with the increased emphasis on chronic disease management, health promotion, disease prevention, and rural workforce challenges, point to significant opportunities for growth and innovation that fall clearly within the nursing practice domain.

Social Networking

Social networking techniques, while most commonly associated with sites such as Facebook and MySpace, also have found applications within health care. Proliferation of health-related social networking sites such as *http://Dailystrength.org*, *http://Patientslikeme.com*, and *http://fluwiki.com* led the Centers for Disease Control and Prevention and the American Cancer Society, among other health care institutions, to use *SecondLife*, a popular virtual world site, to promote awareness of disaster planning, good nutrition, cancer prevention, and other healthy behaviors.

Social networking technologies can assist providers as well as patients. Schoolhealthlink used social networking to reduce the isolation of, and provide continuing education for, rural school health nurses. The prominent role of nurses in Schoolhealthlink contributed to its popularity, utility, continued growth, and potential appeal for similar applications in rural health.[32] The Nursing and Midwifery Electronic Community of Practice (E-CoP), also known as the GANM (Global Alliance of Nurses and Midwives), provides an example of community ownership and interactivity within the nursing social networking space. The E-CoP has over 1,800 members in 132 countries and its site contains a robust knowledge base of culturally sensitive and specific tools contributed by members. The site also includes open source literature, a platform for members to interact to reduce isolation, and mechanisms to enhance access to online education. Tapping into the experiences and collective wisdom of "a thousand clinical brains", independent of geographic location, the site enhances knowledge sharing, improves practice processes, and contributes to improved health outcomes.[33]

Distributed e-Learning

The growth of ICT-enabled rural education, which allows providers to learn and practice from within their home communities, may help to address workforce shortages in underserved areas. When students and providers do not have to travel long distances to obtain ongoing professional training, health-related job growth in rural areas may occur. Although many schools and colleges of nursing now offer online education or continuing education courses, the opportunities are not as well marketed or accessed in rural communities.

Financial and technical barriers, such as lack of broadband capabilities, may impede use of HIT/ICT for outreach and education, particularly in rural areas. Nevertheless, when one considers efforts by developing nations that are beginning to surpass more developed nations in providing tele-access, it gives one pause.[33] For example, the African Medical Research Foundation (AMREF) and the Kenyan Ministry of Health are using distributed e-learning and ICT to prepare 22,000 community health nurses to serve in rural and frontier areas.[34] This not only "grows" the nursing workforce, but also creates a network of ICT-literate providers who will use technology to enhance their practice.

The use of e-learning approaches to teach patients, while not new, is an area that warrants additional nursing involvement. Several distance education programs designed by nurses already exist, such as those that instruct mothers about breastfeeding,[35] educate women about breast cancer,[36] inform older adults about health promotion,[37] and teach diabetics about self-management.[38] When one considers that education has been a mainstay of nursing practice, the relatively low number of nurse-led and nurse-designed IT programs for patient education is disconcerting. Using technology for patient education is an area in which nurses can—and should—lead.

Personal Health Records

Personal health records (PHRs) hold great promise for improving health, particularly in underserved rural areas. PHRs can increase the accuracy of health records, improve

patients' confidence in self-care, improve trust between the patient and the provider, and assist with adherence to disease management plans.[39–42] When integrated with EHRs, PHRs provide information about patients' preferences, needs, and progress.[43] As professionals begin to view the patient as partner in health care processes, rural underserved areas stand to benefit most from integrating PHRs and EHRs, because their providers are distributed, facilities are remote, and care coordination is challenging. In addition, the increasingly technology-savvy population demands the same level of advanced IT for managing their health data as they use for managing their bank records. This demand is not restricted to urban dwellers.

Considering the historic involvement of nurses in care coordination, the opportunity, and indeed the need, for more nursing involvement in PHR efforts is clear. Nurses can help ensure that PHRs become key informational sources for continuity of care. To do so, nurses should make certain that the elements included in PHRs meet the needs of diverse providers, as well as of patients and their families. Nursing leadership can substantially and beneficially drive the effective, reliable use of PHRs, as well as evaluation of their impact on patient and provider satisfaction and health outcomes. The Robert Wood Johnson Foundation's *Project HealthDesign*, which targets assisting "technology pioneers to design the next generation of personal health record systems in ways that empower patients to better manage their health and health care",[44] comprises one area where nurses actively engage in PHR research. According to Patricia Brennan, nurses participate in about one third of the *Project HealthDesign* proposals. "Nurses understand how patients with complex illnesses cope in day-to-day living so this is a natural step for nursing. Most Web sites focus on the illness and don't give people the information and tools needed to deal with their condition on a daily basis"[45] (p. 27). Brennan's points demonstrate the natural linkages between PHRs and nursing practice, and illustrate the value of nursing input into the design, implementation, and evaluation of PHRs.

The foregoing examples, by no means an exhaustive list, illustrate just some of the many opportunities for nurses' involvement and creativity in technology applications. Each has some aspect of traditional nursing at its core. The growth of ICT and HIT in rural and underserved areas can be looked upon as an opportunity for nursing to adopt a new medium to meet its mission.

The Nursing Role in Health IT-enabled Care Delivery

A team-based approach involving community members, technology providers, policy makers, funding agencies, and health care professionals is critical to achieving the vision of IT-enabled, improved health care delivery in underserved rural communities. The nursing stakeholders who serve the community, and who thus have a deep understanding of its culture, subcultures, and informal communication channels, are especially vital to developing sustainable rural IT programs.[46] Nursing has had a long history of involvement in medically underserved areas[19] and the shortage of primary care physicians warrants increased attention to alternative care models such as nurse-managed and IT-enabled community care.

Because nurses understand the community and can provide unique insights regarding patient education, family and social dynamics, and day-to-day care, they are highly valuable to the IT development process. As trusted members of the community, nurses can ensure that patients' confidence in their providers is maintained when technology mediates the interaction,[47,48] that technology fits the homes and lifestyles of patients and their families, and that communication methods are both feasible and effective for use in underserved rural areas. Community-based nurses also can serve as change agents or opinion leaders[49] to help communities recognize the possibilities and advantages of HIT.[50] Core nursing skills that can be translated to HIT-enabled care include cost-effective coordination of patients' care needs, and assisting patients in navigating the health care system. To optimize nursing's impact requires proactive nursing leadership and breaking down barriers that may thwart delivery of primary and community care.

Many efforts to deploy HIT-enabled care in rural areas occur with too little nursing involvement. "The lack of involvement of nurses in eHealth has important implications for the proposed expansion of the role of nurses which may involve greater use of eHealth"[51] (p. 6). Factors contributing to exclusion of nurses include lack of forethought by the planners of rural health IT projects, and the low HIT preparedness of many nurses. Thus, the nursing profession needs to address not only the frequent absence of nurses in planning processes for HIT enabled care, but also the development of nursing professionals who have the competence, skills, and vision to take leadership roles on interdisciplinary HIT teams.

Development of these new skills in the nursing profession will require both curricular reform and more effective use of trained nurse informaticians (NIs) in educational efforts. Because they possess dual clinical and informatics skills, NIs can bring new perspectives and increased rigor to project planning. Their involvement on IT acquisition teams can reduce the chances that implemented systems will be technically, culturally, financially, or organizationally inappropriate. NIs understand not only the spectrum of care delivery, but also the fundamental technical and operational challenges in implementing systems that affect them. The NI professional therefore serves as a translator of sorts, a synaptic point that can facilitate patient-centered and team-based IT-enabled care.

An unfortunate consequence of the decline in the number of graduate nursing informatics training programs has been that the current number of NIs is far below the number required to handle current needs. A 2004 survey reported that only 8,750 nurses (less than 0.3% of the 2.9 million registered nurses in the United States) classified themselves as NIs.[52] The economic stimulus bill of 2009 begins to address this workforce problem, calling for enhanced informatics education in the health professions. At present, however, confusion between computer literacy and informatics competency is common within the nursing profession. This is further complicated by a lack of informatics competency among many United States nursing faculty members. As IT-enabled care increases, the need for highly competent informatics nurses will also increase, calling for

concerted efforts by the nursing profession to upgrade and educate cadres of future nurse leaders.

Things are beginning to change in this regard, albeit slowly. Educational initiatives such as AMIA's 10 × 10 program (10,000 informaticians by 2010) arose in response to an estimated need for 6,000 additional NIs and 4,000 medical informaticians by 2010. To date, 119 nurses have completed 10 × 10 classes. Among several new initiatives aimed at increasing nurses' informatics competencies is the TIGER (Technology Informatics Guiding Educational Reform) project[53] for which AMIA is one of the sponsoring organizations. The TIGER project promotes collaboration among nursing organizations to address the critical need in all settings for nurses to have informatics knowledge and skills. In 2007, the National League for Nurses (NLN) partnered with nursing programs at the Universities of Colorado, Kansas, and Indiana and obtained external funding to prepare nurse educators to teach informatics content. The American Association of Colleges of Nursing's (AACN's) Essentials for Baccalaureate, Clinical Nurse Leader, and Doctorate of Nursing Practice Education objectives include new informatics competency goals. Similar objectives appear in the NLN statement on "Preparing the Next Generation of Nurses to Practice in a Technology-rich Environment: An Informatics Agenda." Finally, AACN's spring 2009 "Hot Topics" Conference, "Technology: Transforming Nursing Education," included sessions on information literacy, telehealth, and nursing informatics, among others. The shift has begun, but must be accelerated to keep pace with the speed of change in HIT-enabled care.

Recommendations

This review of the state of nursing with respect to introduction of IT in rural and underserved populations leads the authors to make the following recommendations:

1. Effective deployment of HIT is required to meet healthcare consumers' needs in underserved rural areas. This, in turn, requires the collaboration of many groups: government, universities, health authorities, industry, health professionals, and consumers. Because nurses work across the entire continuum of care, they can play a valuable role in the deployment of IT-enabled healthcare management. This is especially germane in underserved rural locations, where nurses are likely to serve as primary health care providers.

2. Healthcare professionals must design, implement, and evaluate new collaborative models for coordinating care in underserved rural communities. Given the historic role of nurses as coordinators of care, and their deep knowledge of underserved and rural communities, nurses should play critical leadership roles in these initiatives. The new collaborative models cannot only move rural health care toward becoming a truly interdisciplinary practice with improved outcomes, but also can foster a growing leadership role for nursing in this area.

3. HIT systems need to capture relevant nursing data across the continuum of care. Challenges to doing so include differences in terminologies within and across agencies, as well as differences in the data elements used to measure nursing-related outcomes. Some organizations and vendors tend to implement systems without incor-

porating desired inter-professional, standard terminologies.

4. The profession must accelerate preparation of informatics-competent nurses and NIs. This will especially benefit rural areas, which have experienced demographic changes. As noted by Stonier, "An educated workforce learns how to exploit new technology; an ignorant one becomes its victim"[54] (p. 17). Not all United States nurses are informatics literate, and fewer than 800 are certified informaticians. Distributed education technologies can bring informatics education to rural nurses, enhancing informatics literacy and skill development, while educating nurses in their home communities. Reducing isolation and enhancing connectivity will further enable nursing informatics trainees to apply their deep understanding of the area and culture in which they practice to develop culturally and contextually appropriate HIT solutions. Informatics competency is essential for safe and effective nursing practice.

5. When healthcare planners make decisions about implementing rural health IT projects, they must include both nurses with informatics expertise and nurses who work in rural settings. The first group has critical informatics knowledge and skills, and the second has intimate knowledge of community health and information needs. Both perspectives are vital to ensuring that nursing's needs for data exchange and system usability are met, and that underserved rural patients become better served.

6. More of the funded nursing informatics research projects should focus on rural settings and evaluate system impacts there. Demonstration projects must show how to integrate information technologies into underserved rural areas, especially in nurse-led clinics and in home-based care. Evaluations must document the impact of IT-enabled care on underserved rural populations. Representative questions include the following: How well do telehealth and tele-home care applications meet the needs of rural populations? Does HIT empower or isolate patients and their families? Does tele-home care improve outcomes, quality of life, and reduce the use of acute care services? How can nurses make successful technology demonstration projects sustainable? Do rural health care IT interventions diminish the outmigration of providers and patients? Do nurses, patients, and families find PHRs useful, and have they made any impact on health promotion or health care error reduction? Are community or local resources sufficient to support the use of IT-enabled care in rural, underserved areas? Answering these questions will require informatics-competent nurse researchers and adequate funding to support such projects. Unfortunately, there are too few qualified nurse informatics researchers, and there has been a decrease in funding for informatics-related nursing research.[55] Too often, researchers qualified to study how nurses can implement technology to enhance health care for rural and underserved patients are not connected to the clinicians doing the work.

7. More partnerships are needed. Although there are examples of successful public-private informatics partnerships in academia, few of these have been in rural or underserved communities or in health care systems that serve such areas.[56] Corporate partnerships with community-

based rural and underserved caregivers could be a win-win for both groups.

Conclusions

Health care in the United States is highly fragmented, too often unsafe, and infrequently evidence-based. Particularly in rural communities, a severe shortage of healthcare providers exacerbates these problems. Mature and emerging technologies such as EHRs, telehealth and tele-home care, social networking, distributed e-learning, and personal health records can help to transform health care in all settings, and to diminish healthcare disparities between urban and rural settings. Deployment of healthcare IT applications requires leadership from technologically competent providers. In underserved rural communities, nurses are often the front-line healthcare professionals. Because of nurses' roles in the community, they are central to the successful collaborative implementation and evaluation of rural HIT.

Although there are several initiatives aimed at increasing nurses' informatics knowledge and skills, many nurses in the United States lack informatics competencies. Few are certified in informatics, and even fewer are informatics researchers—particularly in rural areas. For their communities to realize the benefits of health-IT-enabled care management, rural nurses, who by nature understand their own communities' needs, may need to collaborate with nursing informatics specialists and researchers, as well as with government, industry, and provider groups.

Nurses have long been patient advocates, patient educators, and case managers. Therefore, the expertise that nurses can contribute to improving the health of underserved rural communities via IT-enabled methods is considerable. A partnership of the nursing profession with regulatory and funding agencies, the HIT industry, and professional organizations could turn the challenges raised in this paper into opportunities to benefit the health and welfare of all. Doing so will require both innovation and strong nursing leadership.

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